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ABSTRACT

This conference panel report focuses on the identification and validation of essential reading skills and on the organization of those skills into instructional hierarchies. The three approaches to research which the panel recommended are the identification and validation of behaviors essential or supportive to the acquisition of competent reading behavior, the identification of the factors which influence the learning and development of essential and supportive skills, and the empirical determination of the optimal hierarchical arrangement of the skills essential to success in reading. (JM)

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CONFERENCE ON STUDIES IN READING

"It was unlawful, as well as unsafe, to teach a slave to read.

'It will forever unfit him to be a slave. He will at once become unmanageable and of no value to his master.'

These words sank deep into my heart. From that moment, I understood the pathway from slavery to freedom. Though conscious of the difficulty of learning without a teacher, I set out with high hope and fixed purpose, at whatever cost of trouble, to learn how to read."

Frederick Douglass

NATIONAL INSTITUTE OF EDUCATION

Washington, D.C.
June, 1975

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JUNE, 1975

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PANEL 10

ESSENTIAL SKILLS AND SKILL HIERARCHIES IN READING

PROBLEM STATEMENT

Determine if there are essential skills or processing skills related to reading, what they are, how to identify and validate them, how they are interrelated, and which are causally related to reading.

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PANEL 10

ESSENTIAL SKILLS AND SKILL HIERARCHIES IN READING INSTRUCTION

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PREFACE

The National Institute of Education (NIE) came into being during 1972. Its authorizing legislation requires the NIE to:

- Help solve or alleviate the problems of, and achieve the objectives of, American Education.
- Advance the practice of education as an art, science, and profession.
- Strengthen the scientific and technological foundations of education.
- Build an effective education research and development system.

In order to aid in meeting these general objectives, the National Council on Education Research (NIE's policymaking body) approved the creation of five priority programs in December, 1973. One of the priority programs was Essential Skills.* Its purpose was:

> To investigate through research and development, ways to aid all children to obtain skills essential for functioning adequately in school and society.

The initial focus of the Essential Skills Program was in the area of reading. Broad guidelines for an NIE effort in reading had been developed in a small conference held on Cape Cod during the late summer of 1973.** During 1974, the Essential Skills Program carried out an intensive effort designed to formulate more specific plans for funding research and development activities in reading. A variety of meetings were held with groups of teachers, school administrators, and scientists to designate directions for the program. The most ambitious of the meetings was held in Washington, D.C., in August, 1974, and directly involved over 175 individuals -- 50 as Conference participants and 125 as consultants to the Conference. This report is the product of one of the 10 panels of the August Conference.

The impetus for the Conference stemmed from a number of concerns about the state of Federal funding of research and development in education. Four concerns stood out in particular for reading.

1. Research in the field of reading was fragmented and noncumulative.

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*During the past few months, the Essential Skills Program has been renamed the Learning Division of the Basic Skills Group. Both the Basic Skills Group and the Learning Division continue to follow the guidelines set out by the National Council in December, 1973 (above).

**See Miller, George A. (ed.) Linguistic Communication: Perspective for Research, International Reading Association; Newark, Delaware, 1974, 45 pp.

2. The Federal Government was not making constructive use of the state of knowledge in the field in their decisions to fund new research and development.

3. There was a lack of positive and firm coordination between the Federal Government and the professional research and practitioner organizations around the country.

4. A large number of scientists in a variety of disciplines carry out research with relevance to reading. We considered it important to attract these scientists to work in the applied areas of educational research.

The Conference itself was a step in meeting these concerns. During the past year, the NIE has been developing plans for funding research and development in reading for the next two years. Suggestions from the Conference have played an important role in this process. But planning is an ongoing process and we hope by publishing and widely disseminating the reports from the Conference to stimulate discussion of the reports, of research and development in the field of reading, and, indirectly, of the plans of the Institute.

To some extent the format for the Conference was influenced by three other similar efforts of the Federal Government. In the area of health research, the conferences leading to the National Cancer Plan and the National Heart and Lung Institute Plan served as partial models. Within NIE, the Teaching Division had held a major planning effort in the area of teaching research during the early summer of 1974. The intent in each of these efforts was to develop a coherent set of documents that would be responsive to the needs of the American public and to knowledge in the field.

We felt it necessary to structure the Conference in two important ways. First, after extensive consultation with scientists and practitioners in the field we arrived at the conclusion that major efforts in the past had often ignored or down-played the critical importance of the stage of reading called "reading comprehension." Although we realized the impossibility of actually separating out "reading comprehension" from the earlier stage of learning to read -- which requires the learner to be able to translate written letters and words into speech -- our advice suggested that the comprehension or "reading for meaning" stage required far more attention than it had received in the past. Consequently, seven of the ten panels focused on problems in this area. Second, to direct the focus of the panels to planning future research we requested the panelists to organize their ideas into general approaches within the problem area, within the approaches to suggest programs for research, and, finally, when possible to specify particular research or development projects.

The seven panels addressing problems in comprehension spanned a wide range of concerns. The first three panels focused on basic research issues. Their panel reports are titled: Semantics, Concepts, and Culture; The Structure and Use of Language; and Attention and Motivation. The fourth panel was asked to consider the problem of Modeling the Reading Process. The fifth panel directed its attention to the issue of measuring how well people read and its report is titled Assessment of Reading Comprehension. The sixth and seventh reports directed themselves respectively at the practical problems of the Application of Existing Reading Comprehension Research and Reading Comprehension and the High School Graduate. The final three panels directed their attention to three pressing concerns in early reading: Learning and Motivation in Early Reading; Reading Strategies for Different Cultural and Linguistic Groups; and Essential Skills and Skill Hierarchies in Reading.

Although the reports have undergone some revision and editing since the Conference, the major part of the work was done in concentrated sessions in the space of a few days. The resulting documents are not polished or exhaustive. They are meant to be working documents to stimulate debate, suggestions, and comments. Such comments or requests for other reports should be directed to:

Director, Learning Division
National Institute of Education
Washington, D.C. 20208

The work of organizing the Conference was carried out by members of the Essential Skills staff at the NIE -- each of the panels had an NIE staff person as a permanent liaison. Special acknowledgments are due to Susan Duffy and Donald Fisher for their assistance in preparing the reports for publication and to Arthur Young & Company for coordination and arrangements before, during, and after the Conference. Finally, the work of NIE cannot proceed without the kind of skill, involvement, and hard work given by the panel chairpeople, panelists, and consultants for this Conference. The ideas and emphases in the reports are the products of their cumulative expertise.

Marshall S. Smith
Conference Chairperson

LIST OF PANEL REPORTS AND CHAIRPERSONS

1. Semantics, Concepts, and Culture, Dr. George Miller, Rockefeller University

2. The Structure and Use of Language, Dr. Thomas Trabasso, Princeton University

3. Attention and Motivation, Dr. Sheldon White, Harvard University

4. Modeling the Reading Process, Dr. Richard Venezky, Wisconsin University

5. Assessment of Reading Comprehension, Dr. Ernst Rothkopf, Bell Laboratories

6. Application of Existing Reading Comprehension Research, Dr. Lauren Resnick, University of Pittsburgh

7. Reading Comprehension and the High School Graduate, Dr. Mina Shaugnessy, City University of New York

8. Learning and Motivation in Early Reading, Dr. Richard Hodges, University of Chicago

9. Reading Strategies for Different Cultural and Linguistic Groups, Dr. Manuel Ramirez, University of California, Santa Cruz

10. Essential Skills and Skill Hierarchies in Reading, Dr. Irene Athey, University of Rochester

PANEL 10

ESSENTIAL SKILLS AND SKILL HIERARCHIES IN READING

INTRODUCTION

Background

This panel report considers issues central to the identification and validation of essential reading skills and to the organization of those skills into instructional hierarchies. In this part of the report we attempt to place the notion of "essential" skills and skill hierarchies into a historical perspective and to pose some broad questions regarding the assumptions underlying the development of this genre of reading curriculums. We then turn to a consideration of the terminology of the field by presenting a set of definitions of the concepts that permeate our discussion of proposed research. The first part of the report concludes with a short statement of the implications of the study of the problem and of the rationale for the division of the research proposals into three general approaches. The body of the report presents the three approaches on which the panel agreed.

In recent years, many new reading curriculums have reflected one or more of four interrelated instructional concerns:

(1) Supported by Chall (1967) and others, new curriculums have tended to emphasize systematic phonics instruction. This approach to teaching the relationship between written and spoken words stresses the correspondences between letter and letter combinations and their sounds.

(2) There has been an increasing emphasis on "individualizing" instruction--an attempt to provide individually appropriate learning opportunities to children within a classroom who come from diverse experiential backgrounds and who have diverse learning rates and styles.

(3) There has been increased attention to developing strategies for diagnosing learning strengths and difficulties and for prescribing instructional strategies and materials based upon the diagnosis.

(4) There has been a growing dissatisfaction with norm-referenced tests as adequate tools for assessing school learning. Associated with this dissatisfaction has been a movement to criterion-referenced tests--measures used to determine whether or not a student's performance meets a criterion of mastery, based on the nature of the learning task rather than on the performance of his peers.

Concurrent with the rise of these concerns has been the behavioral psychologists' development of the methodology of task analysis. Originally used for the construction of programmed instruction curriculums, the task analysis approach of breaking down complex behavior into separate and identifiable components meshed nicely with the four

instructional concerns outlined above. A systematic phonics orientation provided, at least for beginning reading, ready content for the task analyses. The content of later reading (i.e., comprehension) has proved less adaptable to a skills orientation although there have been several ingenious attempts at task analysis at this level. The use of criterion-referenced testing, combined with the concern for continual diagnosis and prescription and set in the context of systematic phonics, has led to instructional systems with discrete and ordered skills which can be independently taught and assessed. These events in turn have allowed for one possible way of implementing individualized instruction--dividing the curriculum into small measurable parts allows the teacher to keep track of each child's individual progress. Such a strategy for "individualization" involves extensive record keeping and requires the development of management systems to coordinate the use of teacher time, materials, and space within the schools. Although this overview has been simplistic it should give the reader some idea both of the historical complexity and of the pedagogic rationale for the movement toward skill hierarchical approaches.[1]

Although this approach has its own inherent logic, it is based on three assumptions which, for the most part, are neither stated or tested. First, there is an assumption that "essential" skills do exist and that these skills can be taught. Moreover, since no one curriculum can include all skills, there is an associated assumption that within each curriculum the set of chosen skills includes all those "essential" to the terminal behavior of reading (however that is defined). Since there exists no single validated list of "essential" skills, the many reading programs vary considerably in their selection of skills for instruction.

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[1]A variety of other issues less directly related to instruction has pushed curriculum developers toward use of skill hierarchical approaches. One of these issues was the movement toward assessing schools and school systems, as well as individual teachers in terms of the outcomes of instruction. Beginning in the 1960's with the requirement for evaluations of Federal compensatory programs, the accountability movement soon spread to the state and local level. During the early 1970's, some states legislated the use of criterion-referenced tests to assess the quality of instruction in their districts. To meet the demands of their states, many districts moved to the skill based approaches to instruction. At the same time, some states began to certify the use of curriculums on the basis of their demonstrated effects on student outcomes in experimental trials. In a process such as this one, the easily measured short-term effects of skill based curriculums have a substantial advantage over curriculums less directly tied to easily measured outcomes.

Second, the progress through an ordered set of skills generally assumes the notion of instructional hierarchies--of sequences of learning activities systematically building upon each other, eventually culminating in reading competency. Most skill hierarchy approaches to reading instruction go even further by assuming both that there are essential "subskills" within the larger skills and that mastery of some of these subskills is in turn dependent upon prior mastery of other subskills. Once again the lack of evidence validating one approach over another allows for considerable diversity among the existing hierarchies. (The determination of whether a discrete and measurable behavior deserves to be labeled a skill or subskill seems to be a matter of definition which is left to the individual author. For example, in one program, mastery of the distinction between easily confused letters such as b and d at the beginning of a word may be a skill, while in a second program it may be considered a subskill within the larger context of paying attention to initial consonants.)

The third assumption is that a skill-oriented instructional program is pedagogically efficient and effective. But the logical and empirical demonstration that a particular skill is essential to the terminal behavior of reading does not necessarily imply that instruction should be concentrated upon mastery of that skill in isolation from other "essential" skills. A particular skill may be learned more efficiently and effectively if it is presented in the "richer" instructional context of material or situations requiring its integration with another "unlearned" skill. Two "unlearned" skills may be better learned in the still richer context of instructional situations demanding their integration with a third skill. In fact, we may find ultimately that the richest instructional context is connected discourse produced naturally by the child.

This panel did not address the overall question of whether skill hierarchical approaches to reading instruction are more or less effective or efficient than other approaches. We agreed that that question is important, but that our job was confined to suggesting research that would contribute to identifying and validating "essential skills" and to constructing empirically valid hierarchies. Indeed, we believed that informative comparisons of the skill hierarchy approach with other approaches cannot be carried out until the hierarchies themselves are validated.

In short, the notion of essential skills and skill hierarchies permeates current educational development of reading curriculums, but it does not yet enjoy the benefit of precise documentation. It therefore seems imperative to confront the relevant issues: Which skills are essential to reading competence? What are the perceptual, linguistic and cognitive processes affecting the learning of these skills? What are the most effective and efficient contexts for instruction of these skills? Do skill hierarchies exist? What methods can we use to identify and validate the hierarchies?

Terminology

Table I defines the terms used throughout this report in discussing research on skills and skill hierarchies. The definitions in the table refer to the logical and empirical analysis of the relationships among skills (including the skill of competent reading behavior) and have no necessary instructional implications. Throughout this report, the reader must keep in mind the distinction between the analysis of the relationships among identifiable behaviors (skills) and the ordering of these skills into logically and empirically valid hierarchies on the one hand, and the pedagogical implications of these relationships and orderings on the other. We raised this issue earlier in the introduction, and we will consider it again in the last approach in the body of the report. Again it must be stated, the identification of a skill essential to the terminal behavior of competent reading (e.g., the ability to discriminate words in printed text) does not imply that isolated instruction in that skill is the most effective pedagogical strategy.

Table I: Definitions of Terms

Skill: A delimited set of observable and measurable behaviors viewed within the context of some terminal objective.

(1) Essential skill: A necessary but not sufficient component of one or more terminal objectives defining "reading" (e.g., ability to discriminate words in printed text).

(2) Supportive skill: Not essential, but may facilitate or improve the acquisition of one or more terminal objectives defining "reading" (e.g., knowledge of prefixes).

(3) Validation of a skill: Evidence that the behavior can be isolated and has an essential or supportive relationship to the terminal objective.

Hierarchy: Any one or more of the following relationships between two or more skills.

(1) Contingent relationship: A set of two or more skills, each essential to the mastery of the next higher skill (e.g., X is necessary to Y, and Y is necessary to Z).

(a) Conjunctive contingent relationship: A set of three or more skills in which more than one skill is essential to the mastery of some other skill (e.g., X and Y are necessary to Z. The relationship of X and Y is undetermined). This relationship has sometimes been called "downward branching."

TABLE I (cont.)

(b) Disjunctive contingent relationship: A set of contingent skills in which there is an essential relationship among the skills, but in which the terminal skills may be achieved by alternate routes (e.g., either X or Y, but not both, is necessary to Z). This relationship has sometimes been called "upward branching."

(2) Supportive relationship: A set of skills in which no single skill is essential to the terminal behavior, but in which mastery does facilitate learning of the terminal behavior.

(3) Part-whole relationship: Two or more skills, one of which includes the other as a part (e.g., X includes Y, but X may or may not be either essential or supportive).

Kinds of Hierarchies:

(1) Developmental: An order of skill learning imposed by the order of emergence of cognitive abilities prerequisite for learning the skill.

(2) Logical: An order of skills derived from an analysis of the terminal behavior into smaller or lower-level units.

(3) Empirical: An order of skills based on (1) and/or (2) which has been validated through research or field testing.

Implications of the Study of the Problem

We have already commented on the potential of research in this area. The results of the work should inform the specification, ordering, and assessment of the content of instructional programs. Beyond pedagogical implications, the work should also provide important behavioral information to guide the study of underlying cognitive processes.

Division of the Problem into Research Approaches

The panel considered a variety of ways of organizing the research required in this area. In a manner appropriate to the content, we ultimately agreed on an essentially hierarchical approach. The first approach focuses on ways of identifying either supportive or essential behaviors (skills). The approach builds on current practice and research rather than anticipating research which may be conducted in the future. Study of the cognitive processes implied by the identified skills is the topic of the second approach. An understanding of these processes seems critical for eventual construction

of valid instructional hierarchies which is the concern of the third and final approach. While this description seems linear in nature, we do not advocate a solely linear funding strategy. Basic research on processes should inform the identification of behavioral skills, but practical attempts to construct instructional hierarchies will also provide insights to researchers interested in basic processes.

APPROACH 10.1

IDENTIFICATION AND VALIDATION OF BEHAVIORS ESSENTIAL OR SUPPORTIVE TO THE ACQUISITION OF COMPETENT READING BEHAVIOR

Approach Rationale

Published lists of reading skills reflect the thinking and experience of many educators and researchers. Moreover, recent research has suggested performance behaviors not included in existing lists that may qualify as essential or supportive skills. Such information should be incorporated in future efforts. The goal of this approach is to determine whether skills identified either from existing lists or from research findings represent behaviors unnecessary, supportive, or essential to the performance of a terminal reading objective. (As indicated earlier, a "terminal objective" may be competent reading behavior itself or some specified skill essential or supportive to the ultimate acquisition of reading.)

Insofar as we do not have a fully specified model of reading acquisition, we cannot actually validate a particular skill. Moreover, we will have to wait upon such a model to assure us that we have actually identified all of the appropriate skills. Nonetheless we believe that the body of available knowledge supports, indeed demands, focused inquiry of the sort we propose.

An important practical problem results from this lack of a fully specified model. The specific skills identified as essential or supportive to a terminal objective of reading will reflect both the compiler's particular "incomplete model" and a definition of the terminal behavior. This situation presents the possibility that different investigators might develop competing sets of skills. One implication is that we should contract multiple investigators for at least the validation activities.

Three programs of research are described below. The first calls for a compilation of skills from existing lists and the second for identification of potential skills from recent research. The third program is directed at validating the candidate skills.

Program 10.1.1: Compilation of Skills in Assorted Instructional Programs or Systems.

Program Statement

This program is directed toward providing an exhaustive compendium of skills included as essential or supportive in any instructional program. In addition, it should provide information about which instructional programs include any given skill.

Program Potential

This program will provide candidate behaviors for validation as essential or supportive skills for Program 10.1.3. In addition, the compilation of skills on which current reading programs focus could provide useful comparative information for school teachers and administrators interested in purchasing or developing their own reading program. Finally, the dissemination of the results should aid the classroom teacher who might be seeking materials to present a specific skill not included in her school's current curriculum.

Program Research Considerations

Researchers should use straightforward descriptive techniques; statements of skills, tallies, recordings, etc. should be sufficient. For this research program, evidence of familiarity with materials (particularly components, detail, etc.) and a willingness to observe programs and to correspond with major authors through well designed questionnaires seem to be more important than sophisticated research skills.

Program 10.1.2: Identification of Potential Supportive and Essential Skills Not Specified by Existing Curricular Programs.

Program Statement

We should not assume that current curricular programs have identified the complete set of essential skills for reading, especially in the area of reading comprehension. Basic research in both early reading and reading comprehension has suggested other "new" skills, i.e., behaviors as yet unidentified in current curricular programs, or standards of behavior that go beyond accuracy of performance. For

example, LaBerge and Samuels (1974) have shown that mastery of a skill may involve more than correct performance; perhaps including facility of processing or automaticity. A review of performance characteristics shown to be at least correlationally related to reading would provide another source of possible skills to supplement Program 10.1.1.

Program Potential

Curricular programs do not often incorporate the results of recent basic research. This program would help the construction of a complete list of currently hypothesized reading skills by adding useful results from recent studies. The information from this program should be useful both to practitioners interested in supplementing their existing reading program and to curriculum developers creating new programs or modifying old ones. Finally, the program will also provide useful data for Program 10.1.3.

Program 10.1.3: Validation of the Relationship Between Specific Skills and the Acquisition of Reading Competence.

Program Statement

We may validate empirically the importance of specific skills for competent reading performance by establishing their relationship to the terminal behavior of competent reading or to some intermediate skill supportive or essential to competent reading. The goal of this program is to determine whether skills identified in Program 10.1.1 and Program 10.1.2 are indeed supportive or essential to the acquisition of reading competence. The kinds of hierarchial relationships which might be identified were described in Table I.

Program Potential

This program will provide the focus for the studies suggested in Approaches 10.2 and 10.3. Even if these approaches are not completed, the information from the validating studies of Program 10.1.3 should be very useful for curriculum designers and teachers. We stress that supportive or essential relationships validated in this program do not necessarily have direct pedagogical implications. The task of researchers carrying out Program 10.1.3 is to validate the relationships among definable and isolable behaviors (skills), not to build efficient and effective instructional hierarchies.

Program Research Considerations

For Program 10.1.3, a test of the part-whole relationship (Table I) would be sufficient to allow one to conclude that a specific skill could be classified as part of "reading." Further specifications, such as a contingent relationship, might provide more complete information on the nature of the skill.

Although this program is not designed to have direct implications for sequencing instruction, in many cases it may be necessary to hypothesize an instructional sequence in order to test the nature of certain skills. For example, in learning to read, mastery of a certain skill may serve a vital function during the acquisition of another skill, but cease to serve any function once the second skill is acquired. Evidence that such skills are relevant must be obtained at the appropriate stage of acquisition. Consequently, a measure of the increased efficiency in acquisition may demonstrate the importance of a skill in a hypothesized instructional sequence, but mastery of this skill may not be demonstrable after the acquisition of other skills. Take, for example, the skill of consonant substitution. This may be a teachable, attainable and important skill at the word recognition stage, but at later stages it is relatively unimportant as a decoding skill, and perhaps is no longer functional in any way. In this instance, as in others, evidence of the importance of the skill would result from interim, not ultimate, measures of performance (cf. White, 1974).

Given the very large number of potential candidate skills, this program will be a lengthy endeavor. We believe that the work is critical, however, and that a careful and controlled initial set of investigations might be a spur to further investigations.

APPROACH 10.2

IDENTIFICATION OF THE FACTORS WHICH INFLUENCE THE LEARNING AND DEVELOPMENT OF ESSENTIAL AND SUPPORTIVE SKILLS

Approach Rationale

It is not enough to have identified essential and supportive skills (the task of Approach 10.1). In order to continue building the body of information needed to construct efficient and effective instructional programs we need to understand the perceptual, linguistic, and cognitive processes which aid or hinder the acquisition of the skills. In its clearest manifestation, the acquisition of a particular skill may be controlled by the cognitive or perceptual development of a child. A child who initially shows "slow" development of certain perceptual or cognitive abilities may not be "ready" to acquire certain kinds of skills deemed essential for reading, while another, more quickly developing child will be ready. In a situation such as this one, a particular sequence of instruction may best be delayed for the first child. In another example, one child might process information more effectively if it is presented in a visual mode while instruction for another child might be more effective in an auditory mode. In this instance the teacher might use different instructional strategies to teach the same skill. We need a better understanding of the following: (1) visual and auditory perceptual abilities and their relationships to the development of reading competence; (2) the effect of nonlinguistic information, syntactic and semantic contextual constraints, and the reader's informational background, and (3) cognitive processes and competencies critical to the derivation of meaning.

Approach Potential

The specification of essential or supportive skills is not, in itself, adequate to generate an instructional program, inasmuch as it does not address the question of what variables may influence the learning of these skills. New knowledge bearing on these variables vis-a-vis reading will serve to strengthen instructional programs.

Division of Approach into Programs

In order to divide up the proposed work in this approach we thought it necessary to segment the field into three crudely sequential but overlapping parts. Following general convention we have focused on perceptual and cognitive processes important to the acquisition of (1) word recognition skills, (2) intermediate decoding skills, and (3) comprehension skills.

Program 10.2.1: Studies in Perceptual Learning and Development.

Program Statement

The focus here is on specifying the nature and function of perceptual processes necessary to the development of early word recognition skills in reading. It is also necessary to determine whether the perceptual processes are amenable to instruction and, if so, to specify efficient and effective strategies for their instruction.

Program Research Considerations

During the last few years, investigators have devoted considerable effort to the study of aspects of visual perceptual skills, their development, and their relationship to reading performance. They have collected much correlational evidence of the relationship between these skills and performance in reading (Rosner, 1972). There has been extensive activity in the development of remedial training programs focusing on visual skills (e.g., Frostig, 1964) which have been disappointing in their effectiveness in improving reading skills. However, it would appear that alternative approaches to the area might be promising. Gibson's (1970) analysis of the distinctive features of alphabet letters and the way in which awareness of these distinctive features develops, has encouraged research with implications for both instructional materials and procedures. Among the attempts to specify optimal methods of presentation of highly confusable letters (e.g., b vs. d), Samuels (1969) and Williams and Ackerman (1971) have studied the effects of simultaneous vs. successive presentation of letters. Most of the work to date has focused on visual discrimination skills and not on other visual skills involving memory and sequencing. These areas need work.

The area of auditory skill development also needs further work. It has been demonstrated (Elkonin, 1963; MacGinitie, 1967; Shankweiler and Liberman, 1972) that children who are having difficulty in beginning reading instruction very often are unable

to perform well on auditory tasks that involve analyzing sounds in words or blending phonemes. Also, it is often argued that deficiencies in auditory skills are more common than deficiencies in visual skills. Again, much of the work to date is correlational (Calfee, Lindamood, and Lindamood, 1973). Preliminary work (e.g., Rosner, 1972) suggests that instruction in fundamental auditory skills may transfer to the acquisition of early reading skills. More work is necessary in identifying the specific deficiencies demonstrated in the range of auditory tasks necessary to reading (including skills involving discrimination, analysis, synthesis, memory, sequencing, etc.), as well as in developing effective means of teaching such skills to children.

Clearly, in reading, the auditory and visual modalities are integrated. There have been a few limited attempts to study the integration of these modalities (e.g., Belmont & Birch, 1964) but we know little about the nature of the integration or how to incorporate the concept successfully into instruction.

Other basic questions include the following: What are the developmental changes with respect to reading skills and strategies, e.g., how is the size of the "perceptual unit" modified over the course of development? Are there procedures that we can use during the acquisition stage that will accelerate the development of mature reading strategies?

These questions should be asked specifically for various populations, such as children who differ with respect to cognitive level. In addition, we should explore the possibility that optimal instructional strategies may differ for children who have failed in reading (i.e., who are identified for remedial instruction).

Program 10.2.2: Studies in the Acquisition of Intermediate Decoding Skills.

Program Statement

It is quite clear that the fluent reader uses a number of sources of information in the process of reading. Graphic information is but one source of information in the word identification process. Orthographic information, lexical information, semantic and syntactic information and nonlinguistic cues may all be used by a reader to aid the process of reading. Techniques for teaching children to integrate these sources of information with word recognition strategies in order to speed the recognition process and make it more automatic are currently being devised (e.g., Dahl, 1974). A concerted effort to focus research on the factors necessary to use the various sources of information to achieve fluency in reading has not yet been made.

Program Potential

Potential for "short term payoff" would appear to be high for research dealing with inter- and intrasentence constraints (cf., Dahl, 1974). Potential should also be excellent for research on the lexical, syntactic, and contextual dimensions.

Program Research Considerations

Other types of cues, including nonverbal, lexical, and relational, assist the child in the decoding process by narrowing the options available. Knowledge related to the use of these components, particularly from a developmental perspective, is extremely limited. The combined use of nonverbal knowledge, knowledge gained from contextual cues and the knowledge of the writing and sound systems deserves careful study.

Program 10.2.3: Meaning and Comprehension.

Program Statement

Identify and verify cognitive processes involved in deriving literal and figurative meaning from printed language forms.

Program Potential

This program will contribute to the long term goal of developing more effective instructional procedures for teaching comprehension skills related to reading.

Program Research Considerations

A major objective in essential skills instruction is the development of strategies for reading comprehension that will enable the child effectively to derive, interpret, evaluate, and apply meaning. The nature of cognitive processes underlying skill competencies that lead to comprehension, however, are little understood.

There is support for the viewpoint that the process of comprehension involves a cluster of related mental abilities rather than a single mental process. This support, however, is largely the result of logical analysis exemplified by the work of Bloom et al. (1956), Barrett (1968), Ruddell (1974), and Guszak (1965). Experimental

data are also present, although limited in nature. Lennon (1960) has summarized some thirty studies and identified components such as a general verbal factor closely related to vocabulary knowledge, understanding of literal meanings, understanding of implicit meaning, seeing the intent or purpose of an author, and perceiving the literacy devices by which the author accomplishes his purposes.

While factor analytic research by Davis (1971) revealed comprehension competencies including recognizing a writer's purpose, attitude, tone, and mood, two of the factors (knowledge of word meaning and the ability to draw inference from the content) accounted for the greater part of the variance, and Thorndike (1974) questions whether these two are not, in fact, one factor. However, a number of people have noted that factor analytic techniques do not necessarily reveal essential skills which are common to all members of the population being tested.

Recent readability research incorporates the study of linguistic factors in text and developmental changes in the comprehension process. These studies provide clear indication of the complex nature of the comprehension process. While several widely used taxonomies posit various comprehension levels and competencies, the empirical research support is meager. A substantial effort is thus critical if essential comprehension processes and competencies are to be identified for purposes of designing instructional sequences leading to improved comprehension.

The development of children's reading comprehension abilities would be expected to be directly related to the development of logical thinking and to their experiential background as posited by Piaget and Inhelder (1958). However, the nature of this relationship has not been clearly defined. We should thus carefully study the development of higher level comprehension abilities in relation to the developmental thinking of the child.

APPROACH 10.3

EMPIRICAL DETERMINATION OF THE OPTIMAL HIERARCHICAL ARRANGEMENT OF THE SKILLS ESSENTIAL TO SUCCESS IN READING (OR IN THE DOMAIN SUBSUMED BY THE LABEL "READING")

Approach Rationale

Approach 10.1 generated a master list of essential and supportive skills for acquiring competent reading behavior. Approach 10.2 called for the study of psychological processes underlying the acquisition of the skills. The next logical step is to determine whether and how the various skills may be organized into optimal instructional hierarchies. (As we indicated earlier, this sort of study does not have to rely on a fully explicated list of essential and supportive skills, but may fruitfully proceed in the absence of complete information. Indeed, it must so proceed until we have a valid and fully specified model of reading acquisition.)

The following statements seem to be prerequisites for determining skills hierarchies in reading:

- Terminal objectives subsume more specific, complex skills;
- Critical behaviors related to specific skills can be described in observable terms;
- Relationships exist among subskills. These relationships can be characterized in a variety of ways, e.g., essential, supportive, or contingent conjunctive or disjunctive (see Table I);
- The skills in a hierarchy are teachable;
- The skills, learning processes, and instructional processes involved in any scheme for determining a hierarchy have content validity.

Unfortunately the existing "essential" skills lists do not meet these prerequisites. Present knowledge does not permit the fine breakdown of skills subsumed by a terminal objective such as "comprehension of text." The validation of a hierarchy for any domain cannot reasonably proceed until the specific skills for that domain have been identified, critically analyzed, and empirically validated. For these steps we will have to await the outcome of such research as that proposed in Approach 10.1 and 10.2.

Furthermore, it is possible that the attempt to create valid hierarchies may only serve to demonstrate the nonexistence or the relative unimportance of instructional hierarchical relationships among skills in the various domains. This discovery in itself would be useful. While the salutary effect on instruction of proper hierarchical arrangements of skills seems obvious, there would also be value in knowing if and where such arrangements are not important.

Approach Potential

At the present time, there is no dearth of lists of "essential" reading skills. Such lists are given in curriculum guides, in the manuals for instructional programs, and, most explicitly, as the bases for skill-centered objective-based approaches to the teaching of reading. As lists, they tend to share reasonable face validity and the support of at least some authoritative opinion. However, the hierarchical arrangements of these skills, where they are so arranged, have not been empirically derived or validated.

The selection of the skills on any lists must be given prime importance (see Approach 10.1). However, if instructional hierarchies do exist, the skill list will be most effective if it is properly understood (Approach 10.2) and properly ordered (Approach 10.3).

Division of Approach into Programs

Because the basic methodological issues involved in the creation of hierarchies have not yet been settled, the first program in this approach will focus on the research methodology itself. The results of this program will be useful in the remaining two programs of the approach: the validation of proposed hierarchies and the validation of hierarchies for specific subpopulations.

Currently, hierarchies are likely to be "best guesses" generated by a task analysis or by some other logical analysis of reading. The hierarchies are not apt to be based on hypotheses derived from a comprehensive model of reading behavior or some other theoretical base. The current state of the methodology for generating and validating hierarchies, then, does not warrant the generation of a research program which will attempt to validate all posited hierarchical relationships for all terminal objectives in reading. We therefore suggest that the scope of the validation projects in Approach 10.3 be somewhat restricted.

Program 10.3.1: Selection of Research Methods.

Program Statement

Determine the research methods appropriate for the validation of skills hierarchies.

Program Potential

The magnitude of methodological problems inherent in this approach justifies the focus of this program. In an extensive review of the literature on learning hierarchies, White (1973) found that the existing research on the validity of learning hierarchies "generally ended in inconclusive results," and postulated reasons for this outcome. Others have also indicated the problems inherent in validating hierarchies. The intended outcome of this program will be to produce research methods which demonstrate conclusively that instructional hierarchical relationships do or do not exist.

Program 10.3.1 is a prerequisite to most projects under Programs 10.3.2 and 10.3.3. If we cannot design satisfactory validation techniques, we cannot effectively undertake 10.3.2 and 10.3.3.

Program Research Considerations

Studies tracing the development of methods to validate hierarchies and/or to employ new methods include Resnick (1971), White (1973), who proposes a systematic process for establishing hierarchies, Bart and Krus (1973), who present ordering or tree theory, Walbasser and Eisenberg (1972), Roudabush (1974), and Gagné (1970).

It is possible that several types of procedures for validating hierarchies will emerge. Two kinds which appear likely are (1) psychometric procedures and (2) research procedures involving direct instructional intervention. The psychometric procedures should help to identify essential skills and reveal contingent relationships and should aid Approach 10.2. Projects involving direct instructional intervention will be necessary to determine transfer relationships for instructional purposes.

If we choose criterion-referenced measures as the most appropriate psychometric techniques for investigating skills and skill hierarchies, we will need to consider additional methodological issues. Inherent in the design of such measures are questions of adequate sampling of skills within a domain as well as other issues connected with the reliability and validity of the instrument.

Program 10.3.2: Validation of Instructional Hierarchies in Reading

Program Statement

Validate those skill hierarchies hypothesized for reading.

Program Potential

Because the notion of skill hierarchies has received much attention in the reading field, it is important to establish their existence or non-existence for certain levels of skill specification (see Table II). The potential for establishing useful hierarchies probably varies with the level of skill specificity under consideration. In fact, we have considerable pessimism that a contingent hierarchical arrangement of reading skills can be validated at all. However, as explained in the approach rationale for Approach 10.3, this negative result would in itself be useful for the design of instructional programs for teaching reading.

Table II: Examples of skills varying by size of unit of behavior analyzed and by specificity

1. Very large units. Description of skills most general.	Example:	reading
2. Large units. Description of skills still general, but more specific than 1.	Example:	comprehension skills (factual information)
3. Smaller units. Description of skills fairly specific.	Example:	visual/auditory association skills such as reading words, or producing the sounds of individual letters, etc.
4. Smallest units. Description of skills most specific.	Example:	auditory and visual skills such as analysis, synthesis, discrimination; skills associated with the encoding of information in memory and its retrieval.

Program Research Considerations

Positive results from Program 10.3.1 are critical to the research under this program. The research design developed under Program 10.3.1

will be used to examine the relationships among elements of hierarchies explicitly or implicitly contained in published reading programs, management systems, and teachers' own instructional schemes. The selection of specific instructional programs for investigation will be guided by data emanating from Approach 10.1.

We should give consideration to projects investigating hierarchies representing different levels of skills specificity or units of behavior (see Table II). The research programs should include the validation of hierarchies relating relatively large units of analysis as well as those relating much more finely scaled units of behavior. This tack would be preferable to an attempt to exhaust the possible hierarchies at any one level of specificity. For example, a research program which sampled from among the possible hierarchies at each of the levels in Table II might be more revealing than an exhaustive search of all possible hierarchies using only very tiny units of behavior (as in level 4 in Table II).

Program 10.3.3: Validation Hierarchies on Different Populations.

Program Statement

Determine whether different arrangements of skills or sets of skills at different levels of specificity are more appropriate for selected subpopulations.

Program Potential

It may be possible to tailor hierarchies for specific subpopulations. This program will focus on such "tailoring." For example, within contingent relationships there are two kinds of branching: (1) those containing two or more skills which are independent and can be acquired in any order but must be acquired, and (2) those containing two or more skills, independent of each other, but only one or the other of which must be acquired. There may be optimal routes for different populations through such branches in skill hierarchies. Similarly, transfer properties of skills within hierarchies may be different for definable populations.

Candidate populations for investigation include nonstandard English speakers, children at varying levels of cognitive or conceptual development, children with different styles of thinking (perceptual or logical), children with certain personality characteristics (impulsive or reflective), and children who have failed to learn to read or who have been designated as high risk in kindergarten.

If we defer the projects under this program until projects under 10.3.2 are completed, they will have more validity. However, the knowledge gained from small projects investigating different populations will be extremely valuable for designing effective instruction for problem readers and high risk beginning readers, as well as for other subgroups of the student population. Following Program 10.3.1, therefore, this program warrants immediate support.

Program Research Considerations

There have been many studies attempting to validate different instructional methods for subpopulations, ranging from certain ethnic groups to populations designated as having an auditory, visual, or kinesthetic preference for learning. These studies have not been successful. Any proposal for research under this program should explain this lack of success, and should give evidence for promising directions. For example, according to Halpern (1970) some children do compensate for what might be considered a deficit in skills essential to reading. Specifically, children with a visual and/or perceptual immaturity, who successfully learned to read, were found to have developed their logical skills to a greater extent than those children who experienced failure.

For this research program particularly, it is prudent to caution against comparing skills different in kind, though it is a likely pitfall in other programs as well. The objectives for each skill can gradually become more complex in at least two ways: (1) the process can change (e.g., from discrimination to association), and/or (2) the content can change (e.g., from morphemes to complex syntactical structures). For example, in research on modality preferences, it is common for researchers to report comparisons of the children's auditory blending of sounds in words and their skill in visual discrimination of isolated letters. Often, no data are given on how these skills are correlated in the population of good readers. Nor do we learn whether the greatest contribution to variance comes from changing the process (auditory blending to visual discrimination) or the content (morphemic level to graphophonemic). If alternate routes to terminal objectives or alternate hierarchies are to be investigated, baseline data from the normal population with reference to both process and content are relevant.

As a final consideration, the research program should be flexible in its conception of the use of hierarchies. For example, we might expect that failures in a skill at one level could be corrected by moving to more specificity in the skills at another level. Equally viable, however, would be the hypothesis that for certain problems in reading, a hierarchical arrangement might be completely inverted. For example, mastery, in the sense of fluent reading with comprehension, of a literary selection through repeated listening at a child's own pace may be a prerequisite to the establishment of motivation or certain global reading concepts, e.g. that reading is a communication process. These may in turn be prerequisite to the mastery of skills at a more specific level, such as decoding, for certain children.

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